



NASAL STABILITY AND FEATURE HIERARCHY

Antonia Y. Folarin Schleicher

University of Wisconsin-Madison

Recent works in phonological theory have focused on the internal structure of segments. Proposals on such internal organization of phonological features are found in Clements (1985) Sagey (1986), Archangeli and Pulleyblank (1986). In all these works, the feature nasal is linked to the supralaryngeal node either directly or through an intermediate node (such as soft palate node or manner node). On the other hand, Piggott (1987), with evidence from nasal consonants deletion in French, proposes a feature hierarchy that links the feature nasal directly to the root node. He argues that the implication of characterizing the feature nasal as one of the manner nodes (or as a feature dominated by the supralaryngeal node) is that the feature nasal is deleted whenever a consonant that bears it is deleted. He claims that his proposed reorganization accords greater autonomy to the feature nasal.

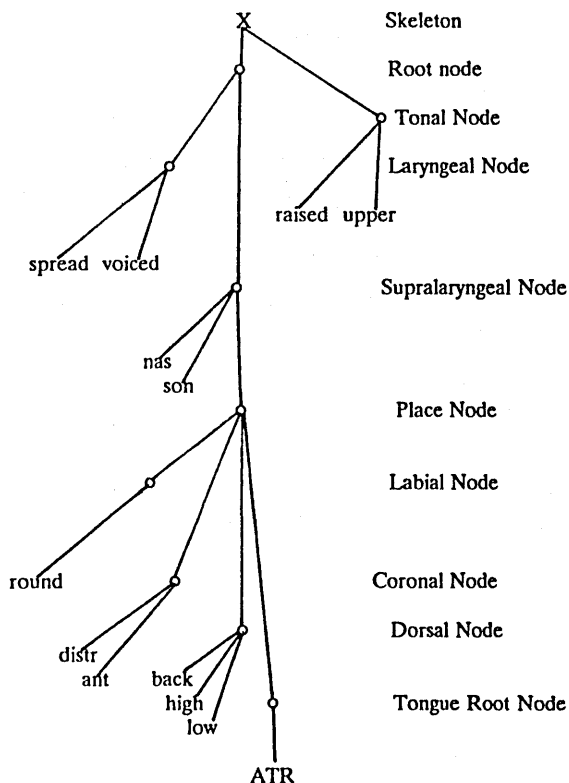
This paper provides an additional support for the autonomy of the feature nasal. Using examples from some Kwa languages e.g., Edo (Bini), Emai, and Yoruba, I will show that the feature nasal survives after the deletion of the vowel that bears it (Nasal Stability). I, however, slightly depart from Piggott (1987) by linking the feature nasal directly to the skeletal node. The treatment accorded the nasal node in this analysis is similar to the one accorded to the tonal node in Pulleyblank (1988). Similarly, by application from the analysis of tones, the feature hierarchy proposed in this paper, gives a principled account of languages such as Mixtec (Cole 1987) where the morpheme that conditions the spread of nasality has no full segments of its own i.e., there is a "Floating Nasal".

The paper is organized as follows. First, I present the feature hierarchy proposed by Clements (1985), which was slightly modified by Archangeli and Pulleyblank (1986) and Pulleyblank (1988), and I show how this feature hierarchy accounts for some nasal assimilation processes in Edo and Yoruba. I then present cases of vowel deletion that create a problem for this feature hierarchy. I follow this with a slight modification of the hierarchy proposed by Piggott (1987), and show how this revised hierarchy accounts for the problematic data. Finally, I present how the hierarchy proposed here accounts for cases of a floating nasal.

I. Feature Hierarchy

Central to the theory of feature hierarchy is the assumption that distinctive features are organized into sets with internal structures. Each set of features constitutes a natural class. One model of this proposal is shown in (1).

1. Model of Feature Hierarchy: (Clements 1985, Archangeli and Pulleyblank 1986, and Pulleyblank 1988)



In the above representation, each node represents a set of features which is characterized as a natural class. Similarly, each node and each feature represents an autosegmental tier which can be the locus of a phonological rule. For example, a rule of assimilation can spread the place node of one segment to the place node of an adjacent segment. Similarly, the rule of assimilation can also spread the terminal feature (e.g., roundness) to an adjacent segment not specified for roundness.

What is crucial, however, to the analysis in this paper is the representation of the feature nasal. In what follows, I will demonstrate how the hierarchy in (1) accounts for nasal assimilation in Yoruba.

II. Nasal Assimilation:

In Yoruba (a Kwa language spoken in the Southwestern part of Nigeria), a sonorant is nasalized when it occurs before a tautosyllabic nasal vowel. For example,

2. a. /àwǎ/ --> [àwǎ] 'they'
- b. /èyǎ/ --> [èyǎ] 'You (pl.)'
- c. /àrù/ --> [àrù] 'disease'

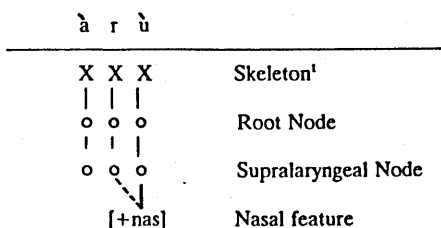
The fact that the initial vowels in the examples above are not nasalized illustrate that we are dealing with a case of "local nasalization" (see Piggott 1987:6).

A similar phenomenon is found in Edo, another Kwa language spoken in the Midwestern part of Nigeria. The following examples are from Amayo (1973):

3. a. /iyá/ --> [iyá] 'yam'
- b. /òwè/ --> [òwè] 'sun'
- c. /èvbè/ --> [èvbè] 'word'

A sample derivation of (2c) shows how the model in (1) gives a correct analysis of all the data in (2) and (3).

4. Derivation of /àrù/:



Since the feature nasal is an autosegment in Yoruba (see Schleicher (in preparation)), there is a rule that spreads the nasal feature, from right to left², to a preceding tautosyllabic sonorant that is not specified for the feature [Nasal]. As shown in (4), the feature nasal spreads from /ù/ to a preceding /r/ but not to /à/, since /à/ is not tautosyllabic to /ù/.

Aside from a tautosyllabic nasal assimilation illustrated above, there are also cases of a nasal assimilation across word boundary. For example, when a noun which ends in a vowel (i.e. V₁) collocates with another noun beginning with a vowel (i.e. V₂), at the phrasal level, there is a postlexical regressive rule which spreads the place node of V₂ to the place node of V₁ (see Pulleyblank (1988)). In addition, if V₁ is a nasal vowel, there is another postlexical nasal assimilation rule that spreads the feature nasal to V₂, which is not specified for nasality. These two processes (i.e., regressive assimilation and nasal assimilation) are illustrated below in both Yoruba and Edo.

5. Edo: Regressive vowel assimilation and Nasal assimilation.

(data from Amayo (1973))

- a. ɓkhɓɓ + éhà ---> ɓkhèéhà
 'evil deed' 'six' 'six evil deeds'
- b. ghèé + ɓzá ---> ghɓ́ɓ́zá
 'look at' 'Oza' 'look at Oza'
- c. èvbè + ɓkpá ---> èvbɓ́ɓ́kpá
 'word' 'one' 'one word'

6. Yoruba: Regressive vowel assimilation and Nasal Assimilation.

- a. èbù + Olú ---> èbòólú
'gift' 'God' 'gift of God'
- b. iyí + ègbá ---> iyèègbá
'pounded yam' 'Egba tribe' 'pounded yam of the Egbas'
- c. itṣ + ewúré ---> itèṣwúré
'thigh' 'goat' 'goat's thigh'

If Pulleyblank (1988) is correct by arguing that, in Yoruba, regressive assimilation spreads the place node as opposed to progressive assimilation which spreads the root node, then the model in (1) will also correctly account for the data in (6). Assuming the same place node spread for Edo, a sample derivation of (5c) will be as shown below in (7).

7.	è	vb	è	ṣ	kp	á	
	X	X	X	X	X	X	Skeleton
	o	o	o	o	o	o	Root Node
	o	o	o	o	o	o	Supralaryngeal Node
	o	o	o	o	o	o	Place Node

Output - èvbṣṣkpá

If we assume the model in (1) for the derivation in (7), the place node of /v/ will correctly spread leftward to assimilate all the place features of the preceding vowel to derive the intermediate form [èvbṣṣkpá]. The feature nasal of the preceding vowel will not be assimilated because, according to the model in (1), the feature nasal is attached to the supralaryngeal node and the supralaryngeal node is a higher node than the place node. Therefore, spreading the place node will only assimilate all the features under the place node but not the features above it based on the hierarchical organization of the features. A nasal assimilation rule will then spread the feature nasal rightward to derive the correct output [èvbṣṣkpá].

It is important to note the independent behavior of the feature nasal from the segmental features (see Schleicher (in preparation) for more information).

I have shown how the model in (1) correctly accounts for nasal assimilation within a syllable and in noun-noun construction in conjunction with a regressive assimilation rule. However, in the following section, I will show how the model in (1) fails to account for cases where the vowel is first deleted and the floating nasal is then relinked unto a skeleton that is not specified for nasality. I argue here for an analysis that regards the behavior of the feature nasal here as a case of relinking a delinked nasal feature as opposed to a case of a nasal spread discussed above.

III. Phrasal Vowel Deletion

There is a large literature on the issue of vowel deletion in Yoruba. Among others, Rowlands (1954), Abraham (1958), Bamgbose (1966), Courtenay (1968), Oyelaran (1971), and most recently Akinlabi (1986), Akinlabi and Oyeade (1986), Folarin (1987), and Pulleyblank (1987) have each presented an analysis on how to determine which vowel is deleted when a vowel deletion rule is applicable. I am not concerned with the plausibility of any of these analyses in this paper. Rather, I am concerned with the behavior of the feature nasal when the vowel that bears it is deleted.

I will concentrate on the postlexical application of the vowel deletion rule (i.e., the vowel deletion rule at the phrasal level) and more crucially on cases where V_1 is deleted. I will not discuss cases where the V_2 is deleted postlexically since in Yoruba, V_2 can never be a nasal vowel in a verb-noun or noun-noun construction, therefore cases of V_2 deletions are not crucial to my present analysis. Neither will I discuss the lexical application of vowel deletion since this is also mostly concerned with a V_1 deletion rule (see Akinlabi (1986), Akinlabi and Oyeade (1986), and Folarin (1987)).

In what follows, I will present some data in Edo, Emai, and Yoruba that present a problem for the model in (1). I will then show how the slightly modified version of the feature hierarchy in Piggott (1987) accounts for these problematic data on vowel deletion. The treatment given to the nasal node in this analysis is similar to the one given to the tonal node (see Pulleyblank (1988)).

In Edo, Emai, and Yoruba, there are cases where V_1 is deleted in a concatenation of a verb plus a noun at the phrasal level. If this vowel (V_1) is a nasal vowel, in most cases, the nasal feature is retained. For example,

8. Phrasal Vowel deletion in Edo: Data from Amayo (1973)

- a. gbé + èbè ---> gbébè
'to write' 'a book' 'to write a book'
- b. bá + òwè ---> bówè
'to peel off' 'leg' 'to peel off your leg'
- c. wā + ame ---> wāme
'to drink' 'water' 'to drink water'

9. Phrasal Vowel deletion in Emai'

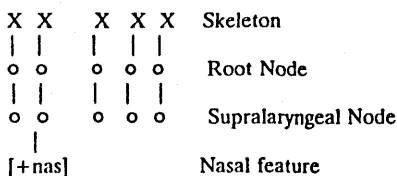
- a. t̃ + éwè ---> téwè
'to roast' 'goat' 'to roast a goat'
- b. f̃ + édì ---> fédì
'to pluck' 'palm nut' 'to pluck palm nuts'
- c. k̃ + ́kà ---> ḱkà
'to share' 'maize' 'to share maize'

10. Phrasal Vowel deletion in Yoruba:

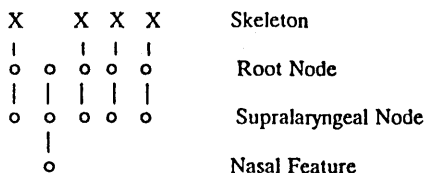
- a. fú + adé ---> fádé
'give' 'Ade' 'give Ade'
- b. gbí + olú ---> gbólú
'to plant' 'mushroom' 'to plant mushrooms'
- c. ʒ̃ + èjè ---> ʒ̃èjè
'to clean' 'blood' 'to clean blood'

All the data in (8), (9), and (10) show that the feature nasal is retained when the vowel that bears it is lost. Assuming the model in (1), a sample derivation of (8b), for example, will yield the incorrect form shown in (12) below.

11. b á ò w è Underlying Form



12. b ó w è



Output - *bówè

The deletion rule above deletes the skeleton node. Following the Surface Visibility Principle proposed in Piggott and Singh (1985), delinked root node must be relinked to a free skeleton in order for it to be realized phonetically. This principle is stated below in (13).

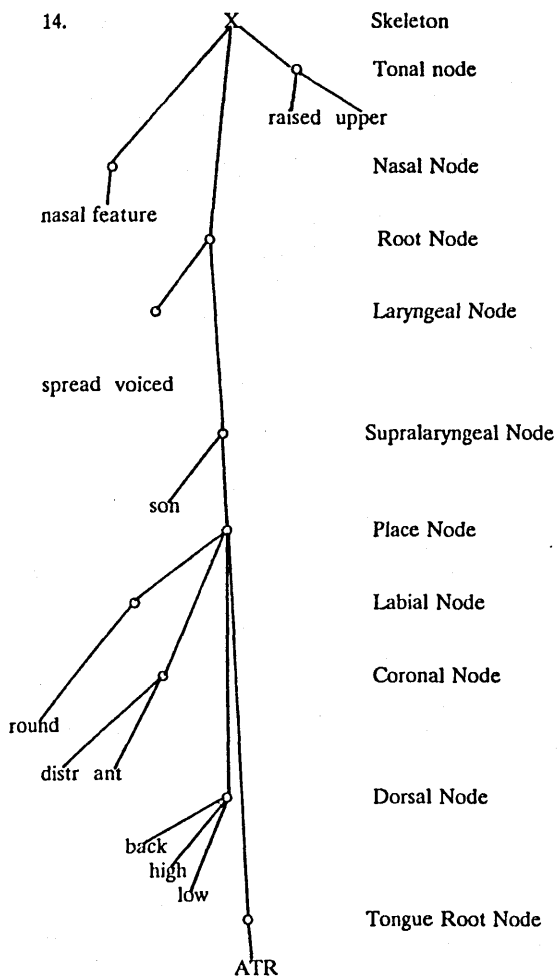
13. The Surface Visibility Principle (See Piggott 1987:8)

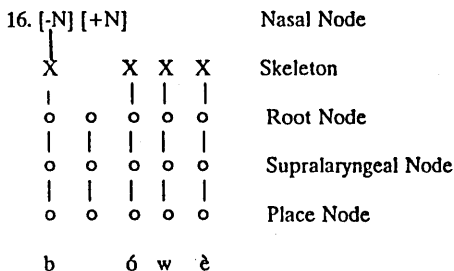
Every root node must be linked to a skeletal position and every skeletal position must be linked to root node.

Since there is no empty skeleton for the floating root node in (12) to relink to, it gets deleted. This is so because, according to Ito (1986), (repeated in Piggott (1987:8)) "all phonological units must be prosodically licensed". If the relinking of a node to a higher node cannot take place, that unlinked node will be deleted. This is what accounts for the deleted feature nasal in (12). Deleting the feature nasal, however, yields the wrong output.

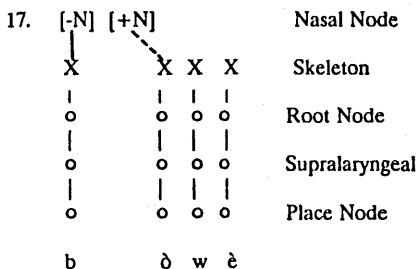
In the remainder of this paper I will present the slightly modified feature hierarchy and show how it accounts for the vowel deletion rule discussed above.

IV. Modified Feature Hierarchy:



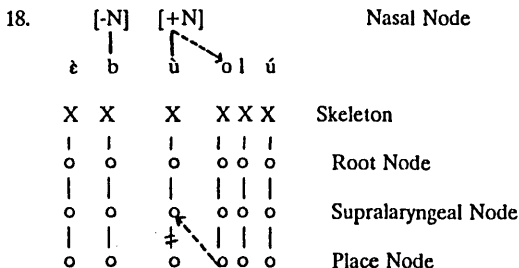


By Surface Visibility Principle in (13), every root node must be linked to a skeleton but there is no skeleton in (16) that is free³ (i.e., without a root node) for the floating root node to dock onto, therefore it should be deleted. On the other hand, there is a skeleton, adjacent to the floating nasal feature, that is not specified for nasality. Therefore the nasal feature is free to relink unto this skeleton. The deletion of the root node and the relinking of the nasal node are illustrated in (17) below.



The fact that the nasal feature does not spread to the two rightmost skeletal provides further evidence that we are here dealing with the case of local nasalization as opposed to long distance nasalization⁴ such as in Capanahua or Sundanese.

Similar to the derivations in (15-17), the Emai and the Yoruba data in (9) and (10) can also be accounted for, in a principled way, using the feature hierarchy in (14). In addition to the vowel deletion data, the hierarchy in (14) also accounts for all the nasal assimilation cases that the model in (1) accounts for. For example, the derivation of (6a), using the model in (14) will be as follows.

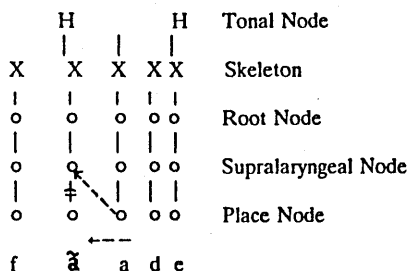


The derivation in (18) shows in a principled way that both the place node and the nasal node can assimilate in different directions.

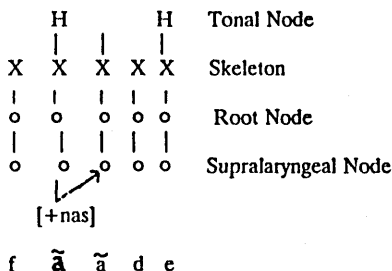
The model in (14) can be considered superior to the model in (1) because it can account not only for the data that undergo assimilation rules but also those that undergo a segment deletion rule without deleting the nasal feature.

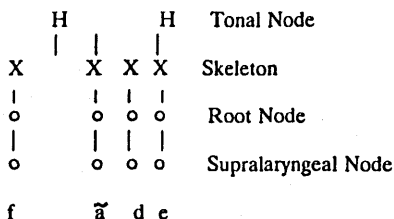
It is, however, possible to argue that the modification in (14) will be unnecessary if one applies the rules of regressive assimilation and nasal assimilation (such as in (18) above) before applying a V_1 deletion rule. In other words the data in (10a) can be accounted for using the model in (1) by applying the following rules⁷.

19. Regressive assimilation rule:



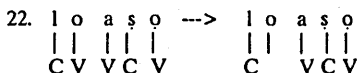
20. Nasal Assimilation rule:



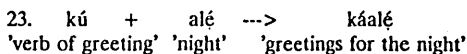
21. V_1 Deletion Rule:

In (19) a regressive assimilation rule assimilates all the place features of /u/ to the place features of /a/, while a nasal assimilation rule spreads a nasal feature from V_1 to V_2 in (20). Finally, in (21), a V_1 deletion rule applies that deletes all the segmental features and the nasal feature of V_1 . These derivations will also yield the correct output [fãdɛ].

Notice, however, that the solution above involves three rules (when the hierarchy in (1) is assumed). Compare this to the solution in (16) and (17) where only two rules are involved. Aside from the advantage of economy that the model in (14) has over the one in (1), if the derivations in (19), (20), and (21) are tenable, we will either have to make a generalization that any time a V_1 is deleted in Yoruba, a regressive assimilation rule must first apply or explain why a regressive assimilation rule does not precede the application of a V_1 deletion rule when the vowel is not specified for nasality. For example, Pulleyblank (1988) illustrated the application of a V_1 deletion rule as follows.



Stipulating that a regressive assimilation rule applies before a V_1 deletion will not only complicate an already complicated rule of Vowel Deletion in Yoruba, it will also be an ad-hoc stipulation since there are cases when a regressive assimilation applies without the application of a V_1 deletion rule. For example,



The example in (23) shows a verb + noun concatenation. There is the application of a regressive assimilation rule, but this is not followed by a vowel deletion rule.

The hierarchy in (14) does not need any extra stipulations that contradict other data in the language. Similarly, since the feature nasal behaves similar to the tonal feature, it only makes sense to accord it with similar autonomy that is accorded the tonal node.

Further evidence in support of the hierarchy in (14) is shown in languages such as Mixtec where there are morphemes that consists of only the nasality feature without any segmental feature. For example,

24. Mixtec (an American Indian language - data from Cole 1987):

a. kužu 'to be deligent' kūžū 'you are deligent'

b. kiʔvi 'to be drunk' kɪʔvɪ 'you are drunk'

The 2nd person singular subject pronoun in this language consists only the feature nasality. If the feature nasal is linked directly to the supralaryngeal node, it will be impossible to account for cases such as in (24) above.

Piggott (1987) also cited a similar case of a floating nasal from Terena where the 1st person singular subject pronoun consists of only a floating nasal feature. For example,

25. Terena (an Amerindian Language - data from Bendor-Samuel 1960 and Piggott (1987):

a. emoʔu 'his word' ɛmɔʔū 'my word'

ayo 'his brother' aʔo 'my brother'

owoku 'his house' ɔwɔngu 'my house'

V. Conclusion

In this paper, I have shown that assuming a modified feature hierarchy in (14) accounts not only for nasal and segment assimilation processes but also for cases where a vowel is deleted but the nasal feature is retained. The

analysis presented here argues for a slightly modified version of the hierarchy proposed in Piggott (1987) where by analogy to the tonal node, the feature nasal is accorded the same autonomy accorded the tonal node by linking it directly to the skeleton. In the analysis of a set of data where a vowel deletes but the feature nasal is retained, the hierarchy in (14) proves to be superior to the hierarchy in (1) not only in terms of economy but also in terms of the fact that no ad-hoc stipulations are necessary to account for other data in the language. If the nasality feature behaves similar to tones in terms of stability, and in terms of its grammatical function independent of other segmental features, then it should be accorded similar autonomy that tone features are accorded in phonological representations.

NOTES

1. The skeleton is a C-slot or a V-slot.
2. Note that a nasal spread from a consonant to a tautosyllabic vowel is always from left to right. For example,

/imú/ --> [imú] 'nose' *[tmú] or *[tmú]

/ɔmɔ/ --> [ɔmɔ] 'child' *[ɔmɔ] or *[ɔmɔ]
3. Emai is also an Edoid language spoken in the Midwestern part of Nigeria. This data is from Francis Egboghare (personal communication).
4. I will ignore tonal analysis here since this is not crucial to my analysis.
5. Linking a root node to a skeleton that is linked to another root node will, in case of a C-slot, derive a geminate, or in case of a V-slot derive a sequence of identical vowels (see Schein and Steriade (1986) on the analysis of geminates).
6. See Piggott (1987) for more information on the difference between local and long distance nasalization.
7. I am assuming the same underlying representation as in (15) and I am again ignoring the details of tonal changes in this derivation.

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